ASTRONOMY.

DOUBLE STARS.—A collection of "Observations of Double Stars made at the United States Naval Observatory," by Professor Hall, has just been issued from the Government Printing Office at Washington. The list includes, besides a small number of stars observed in 1863, with the 9.6 in. equatorial, all the observations of double stars made by Prof. Hall with the 26 in. refractor since 1875. The whole number of observations is 1614.

THE TRANSIT OF VENUS, 1882.—At the sitting of the Paris Academy of Sciences, on the end of May, the Minister of Foreign Affairs transmitted a letter from the British Ambassador, on the part of his Government, desiring to be informed with which French authorities the Royal Society of London should communicate with the view of an interchange of opinions relative to the observations of the approaching transit of Venus. The letter was referred to a committee already nominated.—*Nature*.

CORRESPONDENCE.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

To the Editor of SCIENCE:—

In "SCIENCE" for May 21, Professor Dolbear replies to my criticism of his papers in a manner which, if unanswered by me, is liable to place me in a false light. I, therefore, again request a portion of your valuable space. Professor Dolbear says that, perhaps, he was not guarded enough in some of his statements, and I perfectly agree with him. His reply, too, seems to me to be "not guarded enough." I should be very loth indeed to ascribe to intention what looks very much like an attempt to drag into scientific controversy the legal maxim, "*Falsus in uno, falsus in omnibus.*" When, however, the Professor says that by dealing with the last part of my paper, "it will save saying very much about the first part," it certainly looks as if he tried to apply that maxim. In regard to the quotation from Maxwell's paper published in Vol. XI. of Nature, I frankly own that I never saw it till the Professor's reply drew my attention thereto, and I thus publicly express to him my obligations and thanks for having done so. I cannot, however, admit that this investigation of Maxwell's materially alters the situation. Maxwell treats of molecules and Professor Dolbear speaks of atoms, something altogether different. His results are, furthermore, the mathematical consequences of certain hypotheses in regard to the molecules; but these mathematical deductions do not agree with the results of experiment—the ratio of the specific heats deduced from Maxwell's investigation does not agree with the same ratio experimentally determined. And Maxwell says that in this disagreement the greatest difficulty of the Kinetic Theory of Gases lies. Boltzmann's result applies to a rigid body, and is not general, if I understand Maxwell correctly. Now, it would certainly be more in accord with scientific principles to use an experimental constant rather than a purely theoretical one in such calculations as the Professor's.

Professor Dolbear's reply gives the impression that in $E'-E = \varepsilon$. I regard ε as a ratio when I clearly state that in $E' = \varepsilon \frac{m v^2}{2}$ it must be the ratio $\frac{E'}{E}$ if it is anything; and this is clearly inconsistent with its also being the difference $E'-E$. As, however, the Professor admits the expression $E' = \varepsilon \frac{m v^2}{2}$ to be wrong, we agree on this point, "There is nothing in the first paper that is a deduction from any mathematical work given," says the Professor. In his first paper, Section III., he obtains the equation $\frac{m}{m'} = \frac{v'^2}{v^2}$ and says, "That is, the square of their velocities is inversely as their masses, *so that wave length in the ether will vary as the mass of the atom.*" This looks to me like a deduction from mathematical work, though a strange one. With the second quotation from Maxwell I also perfectly agree, for I did not for a moment think, nor did I say, that ether and ordinary matter are the same. I only maintain that ether *is* matter. To define matter as that which obeys Newton's law of gravitation as Professor Dolbear does, seems to me but little better than to say matter is that which has weight. The defense given for the use of the word density as applied to something which it is claimed is not matter, would, if sanctioned, make sad havoc with the precision of scientific and technical terms. The word density has a definite meaning, and if Professor Dolbear wished to attach to it a new meaning, he should have said so. I confess to no little curiosity to know this new meaning of the word density as applied to ether regarded as non-matter.

I do not by any means wish to restrict Professor Dolbear to one or any other number of planes in arranging his atoms, but I do not see how that improves his position. A radial or triangular prismatic structure is open; and such saturated molecules as HCl, H^2O &c., could not exist. This is, however, but a minor objection to the hypothesis and need not occupy our attention until the more serious ones are removed. It is but a natural and inevitable consequence of this hypothesis to suppose dissociation at absolute zero. And as we do not know anything about matter at absolute zero the necessity of supposing dissociation at that temperature presents to my mind a very great difficulty in applying the hypothesis of synchronous vibrations to explain even the molecular phenomena of adhesion, cohesion, &c. Had I read Professor Dolbear's description of his highly curious and interesting experiments before writing my criticism I should most assuredly have arrayed these very experiments in evidence against his theory, though I feel by no means sure that the formation of one vortex-ring from two may not be due to friction. If it can be shown mathematically that the same results follow in a perfect fluid, I fear the Professor's experiments make an end of the vortex-ring theory.

Now lest any doubt should arise as to the relative position of Professor Dolbear and myself in this controversy, allow me in conclusion to state the case as it appears to me. Professor Dolbear, a well-known scientist, advances new hypotheses; I, an unknown student of science, object to these hypotheses on the ground of insufficient evidence. Then according to the general rules of argumentation the burden of proof rests with Professor Dolbear, and it is for him to remove my objections either by showing that they are not well taken or by overcoming them by further evidence.

WM. H. DOPP.

BUFFALO, N. Y., *May* 24, 1881.

BOOKS RECEIVED.

THE CAT. An Introduction to the Study of Backboned Animals, Especially Mammals. By ST. GEORGE MIVART, Ph. D., F. R. S. 200 Illustrations. Scribner's Sons, New York, 1881.

In this octavo volume of about 600 pages the author has attempted to give what has never been attempted for any other animal in a single volume; viz., a complete account of the domestic cat's anatomy, physiology, embryology and psychology, its place in nature and relations to the external world, its pedigree and origin; in short, its biology.

In the preface the author defines his position, and gives the reason for his book: "The advances of astronomy and geology have produced great changes in men's minds during the last three centuries: biology is pro-

ducing changes as great in the present age. So rapid has been its progress that the natural history of animals and plants needs to be re-written, the field of nature being surveyed from a new standpoint. Such a history may be written in two ways: (1) Living beings may be treated as one whole, their organization being successively portrayed as they exist in the whole series; or (2) one animal (or plant) may be selected as a type and treated of in detail, other types successively more divergent in structure from the first, being described afterwards."

The author has chosen the second plan for this book; and in selecting the cat as type, the principles laid down by Straus-Durckheim and Wyman many years ago, and so clearly presented by Wilder in the *New York Medical Journal* for October, 1879, seem to have guided the author, although he nowhere refers to those writers. The principles are as follows: The type should be of convenient size, abundant and easily obtained; its structure should be nearly enough like man's to render comparisons easy. Such a type may serve as an introduction to the study of the group to which it belongs, and in this book the subject is so treated "as to fit it also to serve as an introduction to Zoology generally, and even to Biology itself."

The opening chapter forms a very pleasant introduction to the subject of the inquiry. It gives the supposed origin of the cat as a domestic animal from the Egyptian cat (*Felis caligata sive maniculata*). Many anecdotes illustrating its character and habits are also given, and its well-known attachment to places is contrasted with the devotion of dogs to individuals. It is stated, as was pointed out in the article in the medical journal referred to above, that different kinds of domestic cats do not differ in size and form as do the varieties of dogs. The difference in appearance is said to be mainly due to the difference in the color, quality and length of the hair. Later in the book (chap. xii.) all the living members of the cat family are described, and many of them are elegantly figured, the figure of the lynx being a good example. Many of the fossil cats are likewise described, the skulls of most being figured, including the curious sabre-tooth (*machærodus smilodon*) The introductory chapter closes with a partial explanation of the "anatomical terms and relations as they exist in the selected type," and a general view of the scope and character of the book.

The plan of the anatomical and physiological part is that followed by most school books upon those subjects, the skeleton or hard parts being given first. The physiological and histological consideration of each system is placed at the beginning of the chapter devoted to the given system. The physiology is, and perhaps properly, what one finds in all good text books of human physiology. Most of the figures of the tissues one recognizes as belonging to the text books of human histology of ten years ago, and the descriptions likewise belong to that date. While one familiar with the tissues of the cat's body would be ready to admit that they may be properly described in terms of human histology, it is to be greatly regretted that the splendid achievements of the last decade have not found place in a work of this character which purports to represent the high-water mark of biological knowledge.

In pleasant contrast with the part just considered is the treatment of the skeleton. The descriptions are excellent, and the subject is rendered more attractive and intelligible by the numerous figures. In fact this part of the book is better and more fully illustrated than any other. The two most striking defects are the descriptions of the articulation of the ulna and carpus (p. 96) and the interarticular ligament of the ribs. The first error is repeated in fig. 60. These errors seem quite inexcusable as the nature of the carpal articulation is very evident in the actual specimen and besides it was pointed out by Straus-Durckheim in his "Anatomie Du Chat" published thirty-five years ago. The true character of the ligamentum interarticulare was described by Meyer in 1834, and has been verified by later writers. It is so evident too that it is hard to understand how it could escape even a superficial dissector.

The muscular system, as a whole, is well done, and the figures, while they lack the elegance and grace of Straus-Durckheim's, are correct and well chosen. There are, however, a few omissions which it is difficult to account for.

The remainder of the anatomy is not of the same excellence as that of the osseous and muscular systems. The account purports to be equally complete, but it is really a curious and confusing admixture of human and feline anatomy. Every anatomist who has examined with care the structure of the cat must have been impressed with its close resemblance to man's. The resemblance, however, does not always amount to identity, but on the contrary the question of homology is often a very difficult one.

The representation of the salivary glands (fig. 88) looks very satisfactory, but the bodies marked (B) and called "accessory submaxillary glands" certainly are not such, and have no connection with Wharton's duct, as may be demonstrated by a fine injection of the same; and "accessory glands" of the parotid if ever present, are only so as anomalies. With reference to the pancreas it is stated (p. 183) that "The pancreas is a large, racemose gland, composed of, and entirely invested by, peritoneum." Further on (p. 191) the pancreas is said to be covered by peritoneum only on its ventral surface. The entire discussion of the peritoneum is fairly correct for man, but very unsatisfactory if applied to the cat (pp. 181, 190–1). In the description of the villi (fig. 94) the following statement is made: "A section of the small intestine, showing the numerous villi, with their orifices directed toward the central cavity." This ascription of orifices to the intestinal villi will probably strike every one who has ever seen them with astonishment.

In describing the structure of the alimentary canal no mention is made of the muscularis mucosæ; and the relations of the ducts of the liver and pancreas are inconsistent with the facts as shown by Cuvier, Claude Bernard and others.

The anatomy of the circulatory, like that of the alimentary system is very unsatisfactory. There are but few figures, and by a curious mistake the walls of the right ventricle of the heart (fig. 102) are shown as much thicker than those of the left. In the general consideration of the subject—the part applying equally to man and the higher mammals—the author, from the immense amount of material, has made a happy selection of the most salient and important points. But in the special consideration, the descriptions are too nearly identical with those of human anatomy. The parts especially faulty are those referring to the vessels of the axillary and brachial regions, to those of the brain and to the azygos vein. Contrary to the statement on p. 197 valves are usually found in the veins of the kidney and uterus as one can easily demonstrate by dissection or plaster injection.

The nervous system is rather briefly but fairly well treated except in some of its details. The figures are mostly good and correct. In the mesal section of the brain (fig. 129) the fifth ventricle is shown as extending the entire length of the corpus callosum; and the figure of the base (fig. 128). exhibits many features which are characteristic of man rather than of the cat.

In contrast with this, however, it is gratifying to find the author following the latest authorities in cerebral anatomy in denying the presence of the great transverse fissure (fissure of Bichat), and in asserting the vesicular character of the hemispheres (p. 267), although in the treatment of the structure and of the brain fissures no

reference is made either to the paper on the cat's brain in Vol. I., No. 5, of this journal, or to any of the special workers mentioned in that paper. And in treating of the functions of the brain, no mention is made of Ferrier, or to any other writer who has added to our knowledge of the localization of cerebral functions.

The peripheral part of the nervous system is more satisfactorily treated, on the whole, than the central part, and the descriptions are illustrated by several excellent original figures. The general excellence is greatly marred, however, by the statement on p. 271 that "The fourth pair of nerves, called also the trochlear or 'from their function of raising the eye-ball' pathetic, etc." A nerve could hardly be said to move the eye in any direction, and the superior oblique muscle to which the fourth nerve is distributed, *lowers* the eye-ball (Quain, Vol. I., p. 277). The description of the vagus or pneumogastric nerve (p. 275), is correct for man as given in the standard works on human anatomy, but it does not represent even approximately the condition in the cat as the simplest kind of a dissection will show; and the assertion (p. 284) that the gangliated cord of the sympathetic ends in a ganglion impar, as with man, is also incorrect.

The account of sensation and the organs of sense is interesting and mainly satisfactory. The author has, in this case as throughout the entire book, introduced his own speculations almost exclusively wherever, from the present imperfect state of knowledge, it was necessary to use the imagination; and the reader conversant with the foremost writers of the day, will probably often find himself on unfamiliar ground.

However faulty one may consider certain parts of the book, he can but congratulate the author on his treatment of reproduction and embryology. He evidently believes that "Whatever God has made is clean," and hence the subject is treated in the same full and open manner that a botanist would treat the fertilization and development of a plant. As the special embryology of the cat has not been fully investigated, most of the statements, as frankly admitted by the author (p. 317), are those supposed to be applicable to the higher mammals generally. The subject is rendered much more intelligible by the addition of original diagrams.

Chapters XI, XII, XIV and XV, treating respectively of the cat's psychology, its place in nature, its hexicology or relations to environment, and finally its pedigree and origin, may be taken together as forming the philosophical part of the treatise. Probably they will be read and discussed more than any other chapters; and from their connection with the other matter in the book, the estimate made of the author as a philosopher will depend more largely on them than on the author's works (Genesis of Species, Lessons from Nature), claiming to be almost exclusively philosophiccal.

Doubtless those who accept the philosophy of Plato and Aristotle will be especially pleased with the chapter on Psychology; but those who believe that some progress has been made over those systems, which were carried to their logical conclusion with such disaster to the human mind in the Middle Ages, will probably experience some disappointment. The manner of treating the subject and the position taken by the author may be gathered from the following quotations: "Psychology denotes the study of all the activities, both simultaneous and successive, which any living creature may exhibit" (p.365). "The psyche, or soul, then, is that principle of individuation which makes the animal what it is, though it has no existence apart from the matter it vivifies. Yet it is the animal par excellence, the matter of which it is composed being but the subordinate part of the compound but indissoluble unity—the living animal." "The terms 'mind' and 'mental act' are not of course properly applicable to the felt neural psychosis of the cat or of any unrational animal. They are here merely employed analogically in deference to popular usage. The 'mind' properly denotes the phenomena of our consciousness." (p. 386). "In fact, all the mental phenomena displayed by the cat are capable of explanation by the former list of psychial powers (such as may be understood to take place without deliberation or self-consciousness) without the aid of any of these enumerated in the above catalogue of truly rational faculties, nor could any of the former, by any mere increase of intensity, change into one of the latter, for they differ not in *degree*, but in *kind*." (p. 373-4.)

The chapters of the cat's place in nature and its hexicology taken together are the most comprehensive of any in the book. In them is given a brief sketch of historical geology, of the entire organic world and of the distribution and relation of animals. Then by means of tables the author gives his views as to the position occupied by the cat with reference to the mineral, the vegetable, and the animal world. In summing up the characters of the cats, their position in the animal world is given in the following language: "But the cats are not only such highly developed carnivora. Something may also be said in favor of their being considered the highest mammals—the very flower and culmination of the mammalian animal tree." (p. 491).

The book fittingly closes with a chapter "on the pedigree and origin of the cat." The part on the pedigree is full and excellent, the graphic method being employed to show the supposed position occupied by the cats and the relation they bear to their allies. When, however, the author takes up the consideration of the cat's origin, he forsakes his usually calm and unimpassioned style, and the heat of the polemic is indicated by the frequent occurrence of such words as "absurd, absolute," etc. It must be a matter for surprise and regret that neither Darwin nor Wallace are mentioned by name; and that the theory which has contributed so largely to the splendid achievements of modern biology should be dismissed thus. "The notion that the origin of species is due to 'Natural Selection' is a crude and inadequate conception which has been welcomed by many persons on account of its apparent simplicity, and has been eagerly accepted by others on account of its supposed fatal effects on a belief in a divine creation." (p. 520). One familiar with the growth, development and present status of the doctrine of evolution must read with astonishment the note on p. 526. "This conception (of psychogenesis) put forward in the 'Genesis of Species' (by Mr. Mivart) seems to be practically admitted, even by the author of 'The Origin of Species'" (Mr. Darwin). It is evident from the foregoing quotations that the author has overlooked the closing sentence of the introduction to every edition of "The Origin of Species" where Mr. Darwin says: "Furthermore, I am convinced that natural selection has been the main, but not the exclusive means of modification." One must also suppose him unfamiliar with the later editions of "The Origin of Species," "Variations of Animals and Plants Under Domestication," the reviews of Professor Huxley and others, where the limitations of Natural Selection, recognized in the sentence just quoted from Mr. Darwin, are clearly pointed out.

As a whole the book is quite free from typographical errors, and the few that are present would doubtless have been corrected if the English plates had not been used by the American Publishers. The author's style is usually simple and pleasing when treating of general matters, but the parts requiring exactness are often marred by insufficient or ambiguous statements that must leave the student in perplexity. For example, in describing the pectoral limb the term "fore-leg" is used (p. 89) to indicate the part between the shoulder and wrist, while further on (p. 103) it is used in one sentence for the part between the elbow and wrist, and in the following sentence it is used with the meaning first given.

To add to the confusion the term "fore-arm" is employed occasionally (pp. 89, 90, 93, 95, 100 and 103).

On p. 445 it is stated that the cat's body "consists almost entirely of oxygen, hydrogen, carbon, and nitrogen, and largely of protoplasm." Students would certainly be pardoned for concluding from this statement that protoplasm is an element simply equivalent to oxygen or any of the other elements enumerated. On p. 456, the following sentence occurs: "Our present task is then to see what is implied in saying the cat is a 'beast' or a 'mammal.'" To do this we must know its relations simply as a mammal, to the other forms of vertebrate life, *i. e.*, to the groups Pisces, Batrachia, Branchiata, Reptilia, Aves, Monocondyla, and to all the non mammalian vertebrates taken together." Here there is no indication whatever that the terms "Branchiata" and "Monocondyla" designate more comprehensive groups than the terms immediately preceding them. Again on p. 524 it is said: "But are not a piece of oak and wood-ashes different substances? Yet does not fire gradually transform the former into the latter?" This sounds like the science of the 13th century; and such a teacher might find himself embarrassed by a student's inquiry of what becomes of alcohol, which under the influence of fire changes neither to visible smoke nor to ashes.

The author's nomenclature conforms as little as possible to the principles of a true scientific terminology so ably presented in No. 38, vol. II, of this journal. He mostly employs the terms of human anatomy, but makes them refer to the natural attitude of the cat instead of to that of man for whom they were designed. Hence such terms as "above," "below" which mean cephalic and caudal respectively in man, mean dorsal and ventral as used by the author, that is, positions differing 90 degrees from those of human anatomy. The use and meaning of the terms are nowhere given, and to add to the confusion, nearly every term proposed in human or comparative anatomy may be found in some part of the book, and often two words are used together, as on p. 176, where the large intestine is said to be "behind" "below" the stomach.

But perhaps the source of greatest surprise and regret to those who are ready to welcome every book of this kind is the absence of references to most of the writers who have contributed to our knowledge of the cat's biology. One unfamiliar with the literature of comparative anatomy would certainly conclude that none but the author had ever made the cat a subject of careful study. No reference is made to Cuvier, and the splendid monograph of Straus-Durckheim on the bones, ligaments and muscles is nowhere mentioned. The frontispiece recalls very vividly the similar, but more artistic figures of Straus-Durckheim. The names of Prof. Huxley and Claude Bernard are absent from the book, and no reference is made to Mr. Wallace or his magnificent work on the Geographical Distribution of Animals. The author might be pardoned for not having seen the scattered papers of lesser writers, but to charge him of ignorance of these would seem about equally objectionable to the accusation of intentionally withholding credit where credit is due.

It is also to be regretted that there is no intimation on the part of the author that there may be errors or omissions in the book, and that no special lines of inquiry are pointed out to the earnest students for whom it was written. In the present state of knowledge, there must be many things concerning any animal that cannot be understood, yet the attempt to treat the biology of an animal in a complete and philosophical manner is a new step, and worthy of all commendation. It is confidently expected that this book, so excellent in plan, will do the best any book can do; it will awaken true interest, and stimulate inquiry in the great field of biology.

SIMON H. GAGE.

ROYAL SOCIETY (EDINBURGH).

PROFESSOR HELMHOLTZ, on April 17, in an interesting communication on electrolytic conduction, stated, that the experiments he was about to describe were a continuation of experiments he had formerly made in connection with certain objections that had been urged against Faraday's law of electrolysis. He had already shown that a feeble galvanic current could be passed through an electrolytic preparation of acidulated water, even though the electromotive force was not sufficient to decompose the water. The action of such a current would be, in the first place, to coat the electrodes, the one with hydrogen, the other with oxygen. The hydrogen however speedily combined with the free oxygen in the air and liquid to form water, while the oxygen on the positive electrode as speedily dissipated itself. In this way the polarization in the electrolytic cell was kept down, so that the original current was never wholly destroyed, In the later experiments Prof. Helmholtz had completely removed the air from the neighborhood of the electrolyte. This was effected by an ingenious use of the property possessed by palladium of hoiding large quantities of hydrogen gas in its pores. With this specially-prepared cell, he found that a feeble current passed through it, fell down to zero in a very short time, the difference of potential due to the polarization of the electrodes quite balancing the original electromotive force. On throwing off the battery the polarized electrolytic cell showed on a delicate galvanometer a reversed current, which rapidly fell to zero from an intensity equal to that of the original current before polarization set in. Another result to which his researches had led him was, that there were no *chemical* forces acting between the molecules of an electrolyte other than those that existed in virtue of what might be called their electric charges—a result which cannot fail to have an important bearing upon the question of chemical constitution.

SIR WILLIAM THOMSON communicated a short paper on the average pressure due to impulse of vortex-rings on a solid. When a vortex-ring is approaching a plane large in comparison to the dimensions of the ring, the total pressure over the surface is *nil*. When a ring approaches such a surface it begins to expand, so that, if we consider a finite portion of the surface the total pressure upon it due to the ring, will have a finite value when the ring is close enough. In a closed cylinder any vortex-ring approaching the plane end will expand out along the surface, losing in speed as it so does, until it reaches the cylindrical boundary, along which it will crawl back, on rebounding, to the other end of the cylinder. As it approaches, it will therefore exert upon the plane surface a definite outward pressure, whose time-integral is equal to the original momentum of the vortex, and a precisely equal pressure as it leaves the surface. Hence, in the case of myriads of vortex-rings bombarding such a plane surface, though no individual vortex-ring leaves the surface immediately after collision, for every vortex-ring that gets entangled in the condensed layer of drawn-out vortex-rings another will get free, so that in the statistics of vortex-impacts the pressure exerted by a gas composed of vortex-atoms is exactly the same as is given by the ordinary kinetic theory, which regards the atoms as hard elastic particles.

PROFESSOR TAIT, in a brief paper on the crushing of glass by pressure, indicated certain results he had obtained by experiments, which were in good accord with the mathematical theory of the strains to which a closed cylindrical glass tube under high pressure is subjected. Of the three stresses, radial, tangential, and longitudinal, which may be regarded as acting upon any elementary portion of the wall of the tube, the two former have a *shearing* effect, to which the crushing of the tube is due. From the few experiments that had been completed it appeared that the shear required to disintegrate ordinary lead glass was about $1 \pm \frac{1}{260}$.— Prof. J. Blyth gave an account of experiments which he had made on the cause of the sounds produced in the microphone receiver. He also exhibited another form of telephone, in which the vibrating membrane was attached rigidly to a copper wire dipping into a column of mercury which formed along with the wire part of the circuit. The inductive effect of the current on itself caused the wire and